

## ABSTRACT OF THE INVENTION

A phase detector having improved dynamic range, frequency range, multiplication factor range, and detector gain. The detector converts a reference signal into a square wave. The square wave signal causes a step recovery diode in a sampling phase detector to trigger on a leading edge to obtain a more consistent and more precise sampling of an oscillator signal. The phase detector includes a saturated amplifier to convert the reference signal to a square wave signal, a transformer to impedance match the amplifier with the sampling phase detector and to generate a balanced output of the square wave signal. The sampling phase detector generates a phase error signal indicative of the phase difference between the reference signal and the oscillator signal. The sampling phase detector includes balanced outputs having oppositely-phased phase error signals. A potentiometer is provided to reduce or eliminate any imbalances in the oppositely-phased phase error signals.